CHAPTER C2

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This chapter is divided into three sections. Section I provides controlling legal requirements, background regarding the development of the current Caltrans vegetation control program, a description of that policy, and requirements for district implementation. Section II provides guidance for vegetation control of native plants in non-landscaped areas. Section III includes legal requirements and instructions for use of pesticides.

There are four appendices to this chapter: a list of approved pesticides, a list of approved adjuvants, a form for use in vegetation management unit plans, and plates to illustrate pruning methods.

Refer to the Maintenance Manual, Volume 2 for planning, scheduling and administrative controls that apply to this program.

SECTION I: LEGAL REQUIREMENTS, BACKGROUND AND POLICY

C2.01 Laws that Relate to the Care of Vegetation in California

(A) The Penal Code, Section 384(a):

This section of the Penal Code relates "to the protection of native trees, shrubs, ferns, herbs, bulbs, cacti, flowers, huckleberry, or redwood greens". This law prohibits negligence including cutting and removing plants growing upon state or county highway right-of-ways, public land, and land not owned by persons performing such acts without written permission from the owners.

(B) Streets and Highways Code, Section 730.5

Section 730.5 relates to the destruction of trees on State highways.

(C) Streets and Highways Code, Section 1495

This code section relates to injury to trees on highways.

(D) Streets and Highways Code, Section 670

Section 670 relates to removal or planting of trees and shrubs on State highways.

(E) The California Environmental Quality Act (CEQA)

This law requires that any project that has a significant impact on the environment requires an Environmental Impact Report (EIR). The annual vegetation control plan may be considered to be a project under CEQA.

In preparing an EIR, alternatives and mitigation measures must be considered. Once an EIR is prepared, it is reviewed by the public and a decision is then made by the agency issuing the permit for the project as to whether or not to proceed with the project.

Laws and regulations regarding pesticide use are outlined in detail in this chapter, Section C2.16.

C2.02 Public Agencies Involved With Cooperative Enforcement Vegetation Control Practices

The following public agencies enforce regulations which affect vegetation control:

(A) California Department of Health Services

Department of Health Services (DHS) develops regulations for worker safety and hazardous material disposal. They cooperate in pesticide illness investigations and monitor domestic water supplies.

(B) Environmental Protection Agency

This is the federal agency responsible for pesticide control. The EPA reviews state and county pest control programs for compliance with federal requirements.

(C) State Water Resources Control Board and Regional Water Quality Control

The regional boards (RWQCB) regulate pesticide container disposal sites and water quality standards.

(D) Air Resources Control Board and Regional Air Pollution Control Districts

The board and regional districts regulate dust control and burning.

(E) Division of Occupational Safety and Health

This division, known as Cal/OSHA, is charged with protection of workers. It enforces laws and pesticide safety in formulations and manufacturing.

(F) California Department of Fish and Game

California Department of Fish and Game (DFG) cooperates in fish and wildlife loss investigations which may have been caused by pesticides.

(G) University of California

The University of California (UC) system is charged with pest control research and providing education to growers and licensees.

For further information regarding pesticide regulation, see this chapter, Section C2.16.

C2.03 Development of the Current Caltrans Vegetation Control Policy

"Vegetation control" refers to the treatment of all plants growing within highway rights-of-way, whether native or in landscaped areas. Caltrans controls vegetation on state highway roadsides to ensure visibility for safety, provide fire-risk management, protect pavement surfaces, control noxious weeds, assist in preventing erosion, and for aesthetics.

A Caltrans vegetation control policy was developed by statewide committee and was established in 1987. This policy called for a narrow clear strip next to pavement edges to control risk of fire, to provide for visibility, to provide space for emergency use, and to preserve the pavement. The policy strongly emphasized use of pre-emergent chemicals to suppress weed growth in the cleared strips.

The 1987 policy was the subject of a 1992 Environmental Impact Report (EIR). (See Section C2.01 (E) above.) The Caltrans policy had been founded on using chemicals to develop fire control bare strips adjacent to shoulder edges. The EIR concluded that integrated vegetation management (IVM) principles should be incorporated in Caltrans vegetation management program.

The EIR study gave new direction to Caltrans vegetation control philosophy, and new policies were implemented as a result.

Although the EIR established that chemicals can be used for vegetation control without compromising public or employee safety, it also expresses the desirability of reducing or eliminating the need to do vegetation control on highway roadsides.

This lower level of vegetation control would reduce herbicides in roadside environments. The Department set goals for reducing herbicide use 50 percent by the year 2000, and to achieve an 80 percent reduction by the year 2012.

The EIR is kept current by annual consideration of program components, using a mitigation checklist.

Designs are being developed which will reduce the need for vegetation control and research on alternative species for establishment along road edges is being conducted. Meanwhile, the guidelines for controlling vegetation contained in the "Caltrans Vegetation Control Policies" (Green Pamphlet) summarize the vegetation control policy of 1987. These policies are subject to district modification where an IVM strategy achieves control objectives.

Vegetation control ideally should be planned by the segment specific decision process described above. The treatment widths recommended in the general policy section below are guides only and are to be adjusted to reflect fire risk and other conditions existing in each segment. Control decisions are to be documented in a file in the district office.

C2.04 Caltrans Vegetation Control Considerations

Caltrans vegetation control policy encourages the growth of native vegetation along highway roadsides. Safety, aesthetics, and compatibility with adjacent land use are the prime considerations in the proper maintenance of vegetation.

Native vegetation and trees on roadsides should be allowed to remain if they are compatible with the surrounding environment, safe highway use, and aesthetics. Vegetation helps to reduce driver fatigue, improves storm water quality by controlling erosion, and assists in maintaining slope stability.

Vegetation should be controlled where necessary for fire prevention, safety, and reduction of noxious weeds. Removal of vegetation is generally restricted to a narrow band adjacent to shoulder edges and that necessary to provide sight distance and protection of highway appurtenances such as guardrails and signs. Integrated vegetation Management control alternatives should be considered on a site-specific basis.

See Appendix C2-C: Vegetation Management Unit Plan format.

It is desirable to retain native vegetation and trees on roadsides compatible with the surrounding environment, safe highway use, aesthetics, erosion and dust control. Vegetation helps to reduce driver fatigue, improves storm water quality; helps control erosion and maintain slope stability and enhances aesthetics.

Districts are restricted to the use of herbicides approved by the EIR. New herbicides may be added to that list only after conforming to the same risk assessment procedures and other considerations for herbicides approved by the original EIR. The maintenance Program maintains a list of approved products.

Herbicides are not currently used for vegetation control on Forest Service land. Future use of chemicals on Forest Service land is uncertain but negotiations are in progress to clarify the environmental issues applicable to forest easements. Vegetation control work in National Forests should be coordinated with the local forest manager.

Roadsides should be managed on a site specific basis. This method provides the flexibility to adequately adjust treatments to the wide variety of roadside conditions.

C2.05 Statewide and District Vegetation Management Teams

The Roadside Vegetation Management Committee (RVMC) was established to research and recommend design changes that reduce vegetation control needs. It also seeks to identify species of vegetation that can be established on highway roadsides to reduce vegetation control needs. The RVMC is assisted by a Public Advisory Liaison (PALS) committee with membership from a cross section of vegetation control interests.

The RVMC has been assigned the following tasks:

(A) Explore design changes that can be established in new and retrofit projects that will eliminate or reduce the use of pesticides.

(B) Make recommendations for vegetation that will be low, slow growing, and need little care, and few pesticides to control.

(C) Development of a data base of sensitive resources along highway roadsides that must be considered in management strategies.

(D) Recommend short term strategies while new design standards are being developed.

The RVMC established the "Segment Specific" concept for planning vegetation control and recommended roadside management teams be established in each district to implement this concept. District Vegetation Management Teams (VMTS) meet to review new designs and recommend changes to achieve minimum vegetation control and to consider life cycle maintenance commitments and other consequences of planned vegetation regimes.

The district team also meets to consider the segment specific annual vegetation control plan proposed by the District division Chief of Maintenance and Operations.

District VMTs review both the annual plan and the mitigation checklist required by the EIR. The checklist implements the EIRs programmatic feature and identifies further environmental studies that might be necessary.

C2.06 Annual Plans

Each district prepares an annual plan for vegetation control. This plan is captured on a computerized format provided by the headquarters Maintenance Program. This plan shall be derived from segment specific decisions in consideration of fire risk management, safety and aesthetics. The plan is prepared each spring and is the reference document for planning and scheduling maintenance operations and for budget planning. The Vegetation Control Plan (VCP) is reported on the veg-con computerized program maintained by the District Landscape Specialist.

Districts will identify Vegetation Management Units which encompass highway segments with similar terrain, vegetation and neighboring land use characteristics. Vegetation control strategies for each segment will be developed by identifying these characteristics and making decision about the degree of fire risk and consequence that exists. Strategies will provide the minimum vegetation control necessary to provide adequate fire prevention or containment. Strategies will not compromise safety or integrity of highway surfaces.

In developing annual plans, districts shall take all applicable factors into consideration, including the following:

- Safety
- Sight distance
- Risk of Fire
- Steepness of slope
- Integrity of highway surfaces
- Presence of environmentally sensitive resources
- Opportunities for design change to eliminate the need for vegetation control
- Aesthetic appeal

C2.06.1 Minimum Vegetation Control: Reduction of Chemical Use

Management unit decisions should identify the minimum vegetation control necessary to ensure adequate safety and system preservation. Decisions should take future needs into consideration, as well as addressing short term needs.

Long term conditions most likely will require physical changes to the pavement edge. These changes should be anticipated, documented and sent to the designer to ensure they are considered when the highway is reconstructed or rehabilitated.

Short term decisions should ensure that vegetation control is planned with chemical reduction goals in mind. The key is to assess the risk of fire starting in the right-of-way and the consequences of that fire escaping to surrounding terrain. Proper fire risk management cannot guarantee elimination of all fires, but should recognize the likelihood that a fire will start, the risk to people, property and the environment, and the difficulty of controlling fires. The level of vegetation control should reflect an appropriate risk management decision. Districts shall make no decisions that pose risk to safety requirements, visibility, or the integrity of structural surfaces.

C2.06.2 Fire Risk Plan

The segment specific fire risk plan is prepared by the District Landscape Specialist for the District Division Chief for Maintenance and Operations. This plan establishes specific fire control measures for road edges while considering the likelihood of a fire occurring and the consequences of a fire to the roadside and to adjacent properties.

Fire potential varies with the type of roadside vegetation and the configuration of the pavement edge. For example, grass on a cut slope with a dike at its base is less likely to be ignited by a loose cigarette or spark than grass on a flat traversable roadside. Similarly, perennial or low growing annual grasses present less risk than tall annual grasses.

The chance and consequences of a fire escaping vary widely with conditions. The consequences of fire spreading to an adjacent forest may be more serious than fire spreading to desert, chaparral or grasslands. Likewise, the consequences of a roadside fire where there is a containment barrier such as a frontage road or wall are less than if the fire can spread unimpeded into the adjacent terrain.

The fire risk plan must be sufficiently detailed to reflect changing vegetation types along road edges and differing adjacent land uses and highway configurations.

See Appendix C2-C: Vegetation Management Unit Plan

C2.06.3 Edge Treatment Plan

Vegetation management should begin at the design stage of a new project. The design of the shoulder edge as it transitions to the roadside is the most important factor affecting the need for vegetation control. Details of this transition affect the need for vegetation control. Such details may include whether the edge is flat, fill or cut, slope steepness and vehicle traversability, paved and unpaved shoulder widths, and drainage requirements.

The design should carefully consider pavement edge transition details that will minimize the need for vegetation control and provide positive, long term relief from this maintenance responsibility. If a design will require maintenance of the roadside, the designer should take into consideration future maintenance strategies. For example, if mowing will be required, the roadside should be graded and left obstacle free to accommodate this activity. Roadsides to be landscaped should be designed to accommodate landscaping features and should consider the need for safe access for personnel and equipment.

Careful attention to design should minimize vegetation maintenance expenditures over the life of the project, facilitate the appropriate vegetation concept, and minimize public concern for vegetation control methods.

C2.06.4 Vegetation Control Plan (VCP)

The VCP should be forwarded to Headquarters Office of Roadside Maintenance by April 1 of each year. It shall contain details for roadside vegetation control, landscaped areas, and roadside rests. Chemical and mechanical programs shall be reported separately. The VCP should include a summary page that describes the district program. This summary page should include the activities used, such as spraying, mowing, and burning, and their frequencies. It should also include explanatory notes as required to present a clear picture of the vegetation control program.

Districts shall ensure vegetation control programs are accomplished in accordance with State and federal laws and Caltrans Vegetation Control Program (VCP) policies.

Each district's VCP shall identify chemicals by quantity and type, and shall identify areas to be mowed.

The mowing plan shall identify all included route segments. In addition, each plan must specify the reasons for mowing, and how the frequency was determined.

The VCP shall also contain planned IVM alternatives and planned control by permit.

See Section C2.06 above: Annual Plans. higher quality material to retain lateral support if repetitive grading is necessary.

SECTION II: CONTROL OF NATIVE PLANTS (NON -LANDSCAPED AREAS)

C2.07 Non-Landscaped Vegetation Control

General non-landscaped vegetation control refers to the integrated vegetation management (IVM) treatment of all vegetation growing native within the highway rights-of-way. This includes treatment by chemical, biological, cultural, mechanical, and manual methods.

C2.08 Disease and Insects

Corrective actions should be taken where trees and native shrubs are affected by disease or insect infestations that are detrimental to the health of the trees or create a significant nuisance to the traveling public or adjacent landowner.

Prior to use of chemical means of control, districts should consider use of natural or biological controls as described in this section.

Some level of infestation is natural and does not impair the health of the plants. Control measures should be employed when the infestation threatens the viability of the plant or when it threatens adjoining properties. No attempt should be made to keep all plants free of all insects by spraying.

Refer to Section III of this chapter: Use of Pesticides, if it is determined that it is necessary to use chemical means of control.

C2.08.1 Biological or Natural Control

Natural or biological control will frequently keep a potential insect infestation under control with only a minimum loss of foliage.

Biological control of pests is accomplished by releasing predators that consume unwanted pests.

The predators are typically insects, fungi or microbes. The advantage of this concept is once the predatory agent becomes established. it continues to exist at a level which is in balance with the availability of the host.

Biological control agents such as Bacillus Thuringiensis (BT) are being used successfully on California oak moth and red humped caterpillars. This material is a bacteria that feeds on the larva (or worm stage of development) of certain moths and butterflies. Successful control of puncture vine by weevil, pepper tree psyllids by wasps and eucalyptus tree long-homed beetle by wasp are other examples of natural control. Research for predators for other pests, for example yellow star thistle and Russian thistle, is ongoing.

It is possible to improve the level of natural control by improving the environment for the predators. Where natural methods are being employed for the control of a pest, chemical pesticides should only be used when an infestation becomes acute. The use of both methods for pest control together is called integrated control.

Biological (or natural) control of weed pests often is the most satisfactory method of eliminating or reducing pests because the long lasting control which normally results lessens workload.

C2.09 Pruning of Vegetation

Prune vegetation to preserve the health and structure of trees and native shrubs, to prevent damage to adjacent property, and to provide safety for vehicular and pedestrian traffic.

Use the following guidelines when developing a pruning program:

(A) Required Clearance for Visibility

Trees and native shrubs should be trimmed to ensure visibility of highway signs and safety devices and to provide 17 feet (5.2 meters) clearance over the traveled way and shoulder.

Trees may be trimmed by permit for purposes of providing visibility to outdoor advertising signs or business property frontage. Refer to the guidelines for evaluating visibility improvements requests from the Office of Landscape Architecture or the district Encroachment Permit Office.

(B) Vegetation Control to Prevent Accumulation of Snow and Ice

When feasible, prune or remove trees and shrubs where snow and ice creates slippery conditions. Pruning or removal in such cases reduces ice by permitting exposure of the pavement to wind and sun.

(C) Removal of Plants or Trees

District Director approval is required prior to the removal of live trees.

Dead plants or trees within the right-of-way should be promptly removed when required for safety or protection of adjacent property.

(D) Pruning

Pruning shall be conducted in conformance with ANSI Standard A300-1995. Refer to Chapter E of this manual.

(1) Directional Pruning

Utility companies encourage directional pruning of trees adjacent to utility lines.

Trees pruned in this manner are generally healthier and have stronger limbs.

Trees that have been subjected to the severe canopy reduction associated with conventional pruning methods are often weakened. However, directional pruning may result in a less pleasing appearance. Overall maintenance costs are lower with directional pruning. Trees with high appearance value should not be directionally pruned.

C2.10 Tree Inspection

Conduct ongoing visual surveillance to detect trees and limbs that may be hazardous to traffic, pedestrians, highway appurtenances, or adjacent property.

It is often difficult to detect conditions such as loss of root support, interior rotting, and split limbs. Trees disturbed by new construction areas or with obvious structural deficiencies may require a thorough inspection to determine appropriate action.

C2.11 Vegetation Control of Specific Areas

Vegetation shall be controlled as follows:

(A) Traversable Slopes (4:1 and flatter)

(1) Consider a control strip up to 8 feet (2.4 meters) wide for maintenance along the outside shoulders of both two lane and multi-lane roadways. Wider strips may be dictated by extreme fire control needs.

(2) Consider medians wider than 36 feet (11 meters) for control strips up to 8 feet (2.4 meters) wide. The presence of glare screen plantings may warrant the total control of median vegetation for appearance.

(3) Medians 36 feet (I I meters) wide and narrower should be considered for control of the entire width for appearance.

(B) Steep Slopes

Consider a strip up to 4 feet (1.2 meters) wide along the tops of embankments and at the bottoms of cut slopes.

(C) Miscellaneous Areas

(1) Control vegetation within 2 feet (0.61 meters) of guardrails, delineator posts and other safety hardware where they are not included in shoulder treatment.

(2) Control vegetation in cut ditches, culvert inlets and outlets to facilitate drainage.

(3) Consider whether it is best to mow interchange areas for aesthetics or fire control in areas with adjacent development.

(4) Mow where required for visibility and sight distance for horizontal curves, ground mounted signs and intersections.

(5) Mow adjacent to buildings as needed for fire protection.

(6) Vegetation control within city limits should be agreed upon by Caltrans and the city.

(7) Do not mow vegetation to a height of less than 4 inches (102 millimeters). Mowing to a lower height risks scalping the ground which can create adverse environmental effects and causing potential damage to mowers. A taller cut may be recommended by the district landscape architect or landscape specialist for specific areas.

(8) Except as provided above, avoid mowing beyond control strips in rural area. Such mowing increases the incidence of fires due to hot mufflers igniting stubble, and encourages broad leafed weed growth by diminishing competition of grasses.

(9) Treat noxious weeds where requested by the County Agricultural Commissioner. Caltrans will cooperate in the area wide control of noxious weeds established by local agencies. This is more restrictive than a desire by adjacent farmers to control weedy pests.

See this chapter, Section III: Use of Pesticide.

(D) Brush And Tree Control

Brush should be considered for control up to 9 feet (2.7 meters) from the edge of the shoulder pavement measured parallel to the slope. Native brush and seedling trees naturally encroach on the roadway in forest and foothill areas. Control brush and seedlings as necessary to provide sight distance on curves and to clear unpaved shoulder areas.

In heavy brush areas, trim and remove brush selectively to avoid a straight or carved edge and to encourage a more natural appearance. Seedlings should not be allowed to become established in designed clear recovery areas. Consideration should be given to avoiding brush cleaning in straight lines. A meandering line gives a more natural effect.

Brush and small trees may be removed with a brush mower or by hand work. When necessary, treat stumps to prevent a resurgence in growth. Do not allow young trees to grow in locations where they can grow to become a hazard to traffic.

Heavy duty mechanical brush cutters are effective for brush control, and where used, cutting should be close to the ground. Limbs on the underside of trees should not be cut with a brush mower. The quality of work should be professional and equal to that required by encroachment or utility permit specifications.

Brush trimmings may be chipped or hauled away. Chips may be spread over the ground in forest areas and other locations. Pay particular attention to the possibility of the chips floating into gutters and clogging drains, or becoming a fire hazard when dry. There are locations where chips should be hauled away for these reasons. In some locations excess chips can be taken to cogeneration plants. Wood chips can be used as an effective mulch in landscaped plantings. Avoid chipping poison oak. Take special care to not spread poison oak chips in landscaped areas. It is also important not to spread pests with chipped material. For example, pine pitch canker can be spread with chipped material.

Mechanical brush removal operations have the potential to start fires in dry conditions. Keep a source of water and fire suppression tools near by. Consider suspending work when extremely high fire risk conditions exist.

See Section C2.27.6: Brush Spraying.

(E) Burning of Roadside Vegetation

Burning of roadside vegetation is a valid method of vegetation control to renew soils, remove unwanted species, and encourage the growth of native species which depend on fire for seed germination. Planned bums shall be included in the VCP.

Any burning of roadside vegetation and slash shall be done in conformance with local burning and air quality regulations. Fire officials shall be notified in advance of planned bums. Burning shall be conducted only when weather conditions are favorable for good smoke dispersion.

See Chapter 1 of this manual: Section 1.23.5: Air Quality.

C2.12 Vegetation Control By Others

Caltrans may issue permits to individuals or organizations for control or harvesting of vegetation. The permittee must comply with all applicable laws and Caltrans policies.

C2.13 Shoulder Grading

Shoulder grading is not an acceptable method of vegetation control. Grading shall be performed for the purpose of restoring lateral support to the pavement edge, and should be limited to the actual area necessary to correct the lateral support problem. It may be necessary to provide a higher quality material to retain lateral support if repetitive grading is necessary.

C2.14 Variances

California has many variations of climate, terrain and native species of vegetation. No single policy can be applicable for all prevailing conditions. Consequently, deviations from stated policies may be appropriate. Exceptions shall be justified in the District VCP.

C2.15 Highway Tree Maintenance

Highway trees are to be maintained in a safe and aesthetic manner at all times. Districts shall employ the best standards of arboriculture, consistent with the practices outlined in publication American National Standard (ANSI) A300-1995 and the ISA tree pruning guidelines.

Keep trees free of weak or dead limbs. When there is time and available funds, thin and shape trees as needed to provide for safety, health and beauty of the tree.

There is a distinction between shrubs, seedlings and trees. A "tree" is a woody perennial plant with a diameter of 4 inches (102 millimeters) or greater (when measured 4 feet (1.22 meters) from the ground), and has a total height greater than 20 feet (6.10 meters).

Only qualified personnel are authorized to fell trees. Maintenance personnel who are not in a current Caltrans Tree Maintenance Classification must be qualified by a Caltrans Tree Maintenance Supervisor before they may fell trees.

Maintenance employees who have non-Caltrans training and experience in felling trees may become qualified through the Tree Feller Qualification Program. Contact Headquarters Maintenance Program, Office of Roadside Maintenance, for assistance if your district does not have a Caltrans Tree Maintenance Supervisor.

C2.15.1 Working in Trees

(A) Laws, Regulations and Policy Pertaining to Tree Work

The California Code of Regulation, Title 8, Article 12, regulates worker safety in tree trimming operations. The American National Standard, (ANSI) Z133.1-1994, provides standard practice for work in trees. In the event of any conflicts between ANSI guidelines and Cal/OSHA regulations, the regulations shall take precedence.

See Chapter 8 of this manual: Protection of Workers. Also refer to the Code of Safe Practices (CSOP) for work in trees, and the CSOPs for the specific equipment employed in the work.

There are different requirements for working around and maintaining clearances to high voltage lines (600 volts and greater) and low voltage wires. Check the above policies and regulations for further information. It is Caltrans policy that all overhead conductors including guy wires, phone wires, cable TV and other lines (whether energized or not) shall be considered live. Such lines shall not be touched by personnel directly or with equipment. Trimmings shall not be allowed to come in contact with the wire. Caltrans crews shall not engage in line clearance operations.

(B) Qualifications for Working in Trees

Only qualified tree trimmers or trainees are to perform work in trees. The safety of tree workers depends upon adherence to the following established regulations, guidelines, safety orders and policies.

While tree trimming operations involving climbing are in progress, there shall be a qualified climber on the ground to direct the operations and to assist in rescue operations if they become necessary.

(C) Clothing

Clothing must be appropriate for the work. Clothing should be close fitting and untorn to prevent the possibility of it being drawn into power or hand tools. Boots or high shoes with full composition soles and heels should be worn. Oxfords and light sports shoes, such as running shoes or cross-training shoes, shall never be worn by climbers in trees.

(D) Climbing Gear

Climbing ropes shall be a minimum of 1/2 inch (12.7 millimeters) first grade, synthetic tree surgeon's rope. The rope shall be approved by the tree maintenance supervisor. It shall be checked frequently by the tree maintenance worker and his or her supervisor for cuts or weakened areas. Ropes shall be kept in separate boxes on the truck where they are dry and not mingled with tools or exposed to fuel. Limbs shall not be lowered with the climbing rope. Separate ropes shall be available for other than climbing purposes.

A tag line must be attached to the safety saddle and shall be used by the tree climber at all times when the climber rope is not secured to the tree and saddle.

Safety saddles must be ANSI approved. Saddles shall be checked frequently for weakened parts, and repaired or discarded when not safe to use. Spurs shall not be used in highway trees either by State forces or others who are working under permit, except in the removal of dead or dying trees, or in the tops of extremely high eucalyptus, palms or some coniferous trees. Spurs will conform to ANSI standard 2133 or A-300.

(E) Use of Brush Chippers

Brush chippers are important tools for tree workers. It is important that they be used properly and safely in accordance with applicable safety instructions. Only employees that are qualified are to operate these machines. See section for brush removal above for the proper disposal of chips.

Prior to use of brush chippers, review the operating instructions and the CSOP.

(F) Chain Saws

Chain saws are frequently used by tree workers. They may be very hazardous if used improperly. Only operators formally qualified by Caltrans training are allowed to use chain saws. Operators must adhere to appropriate safety instructions outlined in the CSOP and the operators manual.

Prior to use, chain saws must be inspected to ensure a sharp, balanced chain, proper chain adjustment, proper lubrication, overall tightness of bolts and parts, and cleanliness.

Only qualified tree workers and approved trainees shall use chain saws in trees. Two workers are necessary for operations with chain saws in trees. One worker must be on the ground. The worker on the ground shall be qualified in aerial rescue, and must stay in the immediate vicinity to assist the worker in the tree in case of accident.

Pole mounted, hydraulic, chain saws should only be used by formally qualified workers. Such qualification is given in addition to the Caltrans chain saw qualification course.

Apply the following in using chain saws:

(1) Operators shall not use chain saws until they have received instructions on use and care of the saw, and training regarding safety rules.

(2) The chain saw operator should not walk with chain moving.

(3) Saws shall not be operated while alone. Someone must be close by.

(4) The chain must be kept sharp.

(5) The saw should never be forced. The chain should be allowed to do the cutting.

(6) The saw must be kept in adjustment so it will idle without chain moving.

(7) Operators must have a good footing and a firm hold when starting the saw.

(8) Hard hats and eye protection shall be worn at all times when operating a saw.

(9) Ear plugs or muffs, or both, shall be worn when operating a saw.

(10) The chain saw operator or another responsible person must warn others when felling limbs or trees.

(11) The chain saw should be hoisted to the tree worker on a separate line once the tree worker is in the tree and the climbing line is attached to the safety belt.

(12) Chain saws weighing more than 20 pounds (9.07 kilograms) (service weight) that are used in trees should be supported by a separate line, except when working from an aerial lift device or during topping or removal operations.

(13) Chain saws weighing less than 20 pounds (9.07 kilograms) (service weight) may be carried on the tree worker's belt after being hoisted into the tree. This can be accomplished by attaching a short safety line to the chain saw handle and the tree worker's belt. The safety line should be of sufficient size and length to allow the saw to drop below the worker in case of an accident.

(14) Chain saws in use in trees should be shut off when changing working positions.

(15) Only safety type chains (anti-kickback) should be used on chain saws. These have less tendency for kickback than do cross cut chains.

(16) Workers using chain saws on the ground are required to use industry approved leg protection (chaps). Such protection is optional for workers in the trees.

(F) Personnel Hoists and Hydraulic Tools

Operators of personnel hoists must be qualified by the maintenance program and must follow safety procedures in the COSP.

ANSI Z-133.1-1994 provides guidelines for distance to maintain from electrical wires. Cal/OSHA requires line clearances for wires containing 600 volts or greater.

Caltrans workers shall avoid contact with all electrical lines carrying over 600 volts. Even when a line carries less than 600 volts, workers shall work no closer than within 3 feet (0. 9 1meters) of the wire.

C2.15.2 Topping (Heading) Highway Trees

Highway trees shall be topped only if extreme height has made them a hazard to traffic or property. Consideration should be given to removal of the tree before topping or thinning. Live tree removal must be approved by proper district authority. Tree topping may be an alternative option to removal in some cases.

Topping of trees shall be done by drop-crotching to healthy, strong lower crotches and laterals in accordance with ANSI A-300 standards. Cut to laterals no less than one-third of the diameter of the original limb and remove no more than one-quarter of the total leaf surface. A topping job shall result in a well balanced and proportioned tree of natural shape for the species. The sides must be reduced in spread in proportion to the amount of top cut off. Directional pruning is an exception to this policy and shall be approved by the district landscape specialist.

No stub or ledge cuts shall be left after the removal of limbs. Undercut all limbs before removal to prevent breaks or tearing of the bark. Final cuts shall be made nearly flush with the parent branch or trunk, leaving a callus ring but not a stub.

See Appendix C2-D: Illustrations in Pruning Methods.

C2.15.3 Tree Removal

When removing a tree that is outside the limits of blading or mowing operations, cut the trunk level with the surrounding ground. Either remove the stump or cut it off 8 inches (0.2 meters) below the surface when it is within the limits of blading or mowing operations. The recommend method of stump removal is grinding.

Stumps of species of trees which continue to sucker after tree removal shall be treated chemically or the stump should be removed by grinding. Glyphosate and triclopyr are suitable chemicals for this purpose. The District Landscape Specialist must provide a chemical use recommendation prior to use of stump treatment.

C2.15.4 Arboricultural Practices

Tree surgery procedures are rarely performed on trees in highway rights of way. If it is required it should be performed in accordance with appropriate ANSI standards.

C2.15.5 Tree Removal in National Forests

The State may remove trees within the easement boundary that are deemed hazardous by the State. In addition, the State may remove small trees that encroach on lines of sight, or for safety purposes as specified in the approved plan. Removal and disposal of these trees will be coordinated between the District Ranger and the Maintenance Manager.

SECTION III: USE OF PESTICIDES

C2.16 Laws and Regulations Regarding Use of Pesticides

The terms used in the laws and regulations sometimes have a different meaning than words in common usage.

The words "shall" and "may" are used extensively in laws and regulations. Their meanings are quite different. "Shall" is mandatory, "may" is permissive.

The term "pesticide" means any material used to control pests. Examples are insecticides (control insects), herbicides (control vegetation), rodenticides (control rodents), and avacides (control birds).

The terms "pesticides" and "economic poison" have the same meaning in the law.

(A) Food and Agriculture Code

This code defines the roles and responsibilities of county agricultural commissioners and the Department of Pesticide Regulation (DPR) in relation to the use of herbicides. Section 11501.1 relates to the field of pesticide regulation. The control of economic poisons rests with Cal/EPA and not local agencies. This law does not change in any way the present relationship between the county agricultural commissioner and Caltrans for pesticide purchases and application within each county. This division is not a limitation on the authority of any State agency or department to enforce or administer any law or regulation when they are given that authority.

Sections 5501-5509 (AB 1245) provides for the control of roadside vegetation by adjoining landowners under permit.

(B) Penal Code

This code lists penalties for not complying with state pesticide regulations and laws. Caltrans may be held liable for the actions of its employees. Employees who negligently or intentionally misuse pesticides may be held criminally liable for their actions. An employee is "negligent" if he or she does not use reasonable care. An employee "intentionally" misuses pesticides when he knows that he is breaking the law, but acts in an illegal manner.

(C) Streets and Highways Code

Section 862 describes the liability of public entities for injuries caused by the use of pesticides.

An intentional violation of the law which creates, or could have reasonably created, a hazard to human health or the environment, the convicted person shall be punished by imprisonment not to exceed one year or by a fine of not less than $5,000 nor more than $50,000 or by both.

(D) General Industry Safety Orders (GISO)

GISO Section 3204, known as "Employee Right to Know", provides employees the right of access to relevant exposure or medical records. Each employee has the right and opportunity to examine and copy any data in the employee's medical and exposure records. An employee may also give written authorization to a designated representative for access to the information.

C2.17 Other Agencies Involved in Cooperative Enforcement of Pesticide Laws and Regulations

(A) California Department of Health Services (DHS)

The DHS develops regulations for worker safety and hazardous material disposal. They cooperate in pesticide illness investigations and monitor domestic water supplies.

(B) Environmental Protection Agency (EPA)

The EPA is the federal agency responsible for pesticide control. The EPA reviews state and county pest control programs for compliance with federal requirements.

(C) State Water Resources Control Board and Regional Water Quality Control Board

The State and regional boards regulate pesticide container disposal sites and water quality standards.

(D) Division of Occupational Safety and Health (Cal/OSHA)

Enforces worker protection laws and pesticide safety in formulations and manufacturing.

(E) California Department of Fish and Game (DFG)

The DFG cooperates in fish and wildlife loss investigations which may have been caused by pesticides.

(F) University of California

The State university system is charged with pest control research and providing education to growers and licensees. University of California

C2.18 Certification for Applicators of Restricted Materials

The amended Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) has two key provisions:

- The U.S. Environmental Protection Agency (EPA) is required to classify all pesticide products for "general" or "restricted" use.

- Restricted use pesticides may be used only by, or under the direct supervision of, certified applicators.

California Department of Pesticide Regulation maintains a list of restricted materials that includes pesticides and any material that USEPA or CAL EPA have designated as restricted.

(A) General Use Pesticides

"General use pesticides" are those that will not ordinarily cause unreasonable adverse effects to the user or the environment when used in accordance with their registered labeling instructions. Such products are available to the public without further restrictions other than those specified in the labeling.

(B) Restricted Use Pesticides

"Restricted use pesticides" are those which may cause adverse effects to the environment or the applicator unless applied by competent persons who have demonstrated their ability to use these products safely and effectively.

(C) Pesticide Applicator Certification

Federal law states that no person shall apply restricted use pesticides unless that person is certified or is supervised by a certified or licensed applicator.

The law recognizes two types of pesticide applicators:

(1) Private Applicators

Private applicators include farmers, ranchers, orchardists, or other applicators who use or supervise the use of restricted materials to produce an agricultural commodity on property they own or rent.

(2) Commercial Applicators

Commercial applicators are those who apply or supervise the use of restricted materials on any property other than as provided by the definition of "private applicator".

Caltrans personnel who apply restricted use pesticides are considered "commercial applicators" and shall either be certified through an applicator certification program, or supervised by a certified applicator.

(D) Requirements for Qualified Applicators Certification (QAC)

Commercial applicators will be certified by the California Department of Pesticide Regulation after passing examinations designed to meet EPA competency standards.

The following are the categories of pest control established by the California Department of Pesticide Regulation for applicator certificates:

CATEGORY	CERTIFICATION
A	Residential, industrial and institutional
B	Landscape maintenance
C	Right of way
D	Agricultural
E	Forest
F	Aquatic
G	Regulatory
H	Seed treatment
I	Demonstration and research
J	Health related

C2.19 Recordkeeping

Pesticide applicators are required to keep adequate records. These records shall be kept by the person on the job, in charge of the operation.

State law requires that the information on this report be kept for 30 years. The computer reporting system used by Caltrans meets this requirement. Pesticide use is reported to Sacramento on a daily basis via electronic time sheets approved by supervisors. An end of month, summary is electronically sent to DPR.

The following information shall be included:

(A) Location of application (include County, Route, Post Mile limits nearest 1/100th mile (0.016 kilometers) , width of application, description of location relative to roadway, e.g., right shoulder, median).

(B) Name of chemical(s) used (include percent of active ingredient and, if stated on label, the formulation (e.g., "DF" for dry-flowable or "W" for wettable powder).

(C) Rate of chemical(s) per acre (0.406 hectare).

(D) Purpose of treatment.

(E) Total acres treated.

(F) Total gallons (liter) sprayed.

(G) Actual time of spraying.

(H) Approximate wind speed and direction.

(I) Personnel, safety gear and equipment involved. Respirator use is recorded separately.

(J) Remarks that clarify any unusual circumstance or happening relating to the use of the chemical.

C2.20 Pesticide Use Recommendations

Herbicides can only be used when authorized by a Pesticide Use Recommendation prepared by a licensed Pesticide Control Advisor (PCA). Field work must be supervised by the holder of a Qualified Applicator's Certificate (QAC). These requirements are for work performed either by Caltrans forces or by contract.

Pesticide Use Recommendations are prepared using information from a contract service accessing a data base for pesticide label information. This ensures that up to date product information with the latest precautions are included in the work order.

C2.21 Requirements for Safe Handling and Storage of Pesticides

The following are legal requirements for pesticide handling and storage.

C2.21.1 Medical Care

For all activities involving the use of pesticides, the employer (supervisor) shall make prior arrangements for emergency medical care.

The name, address, and telephone number of the physician, clinic or hospital emergency room providing care shall be posted in a prominent place at the work site, or in the application vehicle if there is no designated work site.

When the employer (supervisor) has reasonable grounds to suspect that an employee has a pesticide illness or when an exposure to a pesticide has occurred that might reasonably be expected to lead to an employee's illness, the employer shall take the employee to a physician immediately, along with the pesticide label if possible.

C2.21.2 Personal Washing Facilities

Regulations require that clean water and soap be available at the work site for washing of hands and face, and for emergency washing of the entire body a minimum of 10 gallons (37.8 liters) of water for one employee and a minimum of 20 gallons (75.7 liters) for two or more employees.

C2.21.3 Storage of Chemicals

The California Health and Safety Code requires each facility that stores hazardous materials to develop a "business plan". This business plan lists the types of chemicals, including pesticides, that are on the premises, the amounts, and storage locations.

Hazardous materials storage areas must be placarded. Post the proper signs on pesticide storage buildings and in outside storage areas. These signs are required by law, and must be placed so they will be readily visible to firefighters or emergency response personnel entering each area.

Chemical pesticides must be stored in ventilated rooms. Fertilizers must not be stored in the same room. Storage areas must be kept locked when not in use. A pesticide storage warning sign written both in English and Spanish must be posted in areas where pesticides are stored.

Chapter C6 of this manual provides additional guidelines for storage of pesticides and other hazardous materials.

C2.21.4 Disposal of Empty Chemical Containers

Pesticide regulations require special attention be given to the disposal of empty pesticide containers.

Pesticide containers that have held less than 28 gallons (106 liters) of a liquid pesticide must be rinsed and drained by the user at the time of use. The containers shall be triple rinsed, with the rinse solution from the container drained into the spray tank.

Pesticide containers shall be allowed to drain 30 seconds into the spray tank after each rinsing.

The rinse solution shall be placed into the mix tank and then applied onto the roadside, in the "target area".

Empty, rinsed pesticide containers shall be perforated, crushed or broken to eliminate the possibility of their reuse for any purpose. Plastic containers may be recycled by the County Agricultural Commissioner.

Contact the County Agricultural Commissioner for information on proper disposal areas.

Properly rinsed empty containers shall be taken to these sites.

C2.21.5 Labeling of Spray Rigs and Tanks

A warning decal, "Warning, Not Drinking Water", shall be placed on the rear and both sides of the tanks of all spray units.

A "Do Not Drink" decal shall be placed near each of the fresh water tank valve outlets so that it can be easily seen.

Two placard holders shall be mounted, side by side, near the main outlet of the tank so that it is easily visible from the rear of the unit. Placards with the name of the chemical being used and containing appropriate warnings will be in place during spray operations. Placards may be obtained from Material Operations.

C2.22 Environmental Concerns

In preparing vegetation control programs special consideration shall be given to the possible herbicide contamination of surface and ground water. Maintenance operations shall be conducted with full consideration for potential effects on water quality, air quality, sensitive species and other environmental resources.

Refer to Chapter C6 of this manual for further information for water quality issues.

Refer to Chapter D5 for procedures to be followed in the event of spills of hazardous materials on highways.

C2.23 Toxicity of Chemicals

Toxicity is the capacity of a material to cause injury or death. Toxicity ratings are expressed for each chemical used in pesticide work. These toxicity ratings are expressed as Oral or Dermal LD 50. LD 50 means lethal dose that will kill 50 percent of a group of laboratory animals. It is expressed in terms of milligrams of material for each kilogram of body weight. The lower the number on this scale the more hazardous the material.

Pesticides may enter the body by one or all three of the following routes: skin absorption (dermal), ingestion (oral) or inhalation.

Maintenance personnel shall not use any material with an LD 50 lower than 100. Use the pesticide with the lowest toxicity (the highest LD 50 number) adequate to do the job.

The following scale is provided for judging the toxicity of pesticides:

COMMONLY USED TERM	LD 50	PROBABLE LETHAL DOSE FOR HUMANS
Extremely Toxic	less than 1	A taste or grain
Highly Toxic	1 to 50	1 pinch to I teaspoon
Moderately Toxic	50 to 500	1 teaspoon to 2 tablespoons
Slightly Toxic	500 to 5,000	1 ounce (.028 kilograms) to 1 pint (.473 liters)
Practically Non-Toxic	5,000 to 15,000	1 pint (.473 liters) to I quart (.946 liters)
Relatively Harmless	15,000 or more	Greater than I quart (.946 liters)

These toxicity values are expressed as LD 50 in terms of milligrams of the chemical per kilogram of body weight of the test animal milligrams/kilograms (mg/kg).

Although LD 50 ratings may not appear on pesticide labels, the following terms are set by law and can be used to judge the acute hazard of the material:

SIGNAL WORD	WHEN REQUIRED
"DANGER POISON" (If "Poison" then label contains skull and crossbones)	All highly toxic compounds with an LD 50 range of 0 to 50 mg/kg
"WARNING"	Moderately toxic compounds with an LD 50 range of 50 - 500 mg/kg
"CAUTION"	Slightly toxic compounds with an LD 50 range of 500 to 5,000 mg/kg

No special words are required for compounds with an LD 50 greater than 5,000 mg/kg. However, they must have the statement "Keep out of reach of children".

There are four general categories of pesticides based on these toxicities. A knowledge of the meaning of the signal words and symbols forewarns the pesticide user of potential hazards associated with the chemicals.

CATEGORY	SIGNAL WORDS and SYMBOL	NOTES
1	"DANGER - POISON" if "Poison" then label contains skull and crossbones symbol	Some pesticides carry only the signal word "Danger" without "Poison" or the skull and crossbones symbol. They are in Category 1 due to a specific hazard, such as potential for skin or eye injury, and are highly toxic.
2	"WARNING"	Moderately toxic compounds.
3&4	"CAUTION"	Slightly toxic.

C2.24 Annual Pesticide Worker Safety Training

State law requires annual Pesticide Worker Safety Training for all employees who work with pesticides or may be exposed to their residues. The training is designed to teach safe work practices for employees who mix, load, apply, store, or otherwise handle pesticides.

The training shall include the following points:

(A) Pesticide Labels

The directions on pesticide labels are enforceable by law. It is a violation of the law to use a pesticide inconsistent with the label. Supervisors shall review specific pesticide labels with employees prior to use of any material.

Employees shall be taught how to read pesticide labels. They shall be able to recognize signal words, determine the hazards of the material, and select the types of required personal protective gear.

See Section C2.23: Toxicity of Chemicals.

(B) Emergency Medical Care

Employees shall review the arrangements for emergency medical care for workers involved in activities with pesticides. Medical facility location information must be posted at the worksite.

(C) Specific Safety Procedures

The trainer shall advise all employees of specific safety procedures they should follow in handling, mixing and applying pesticides. Employees shall also receive training on the use of specific safety equipment required by pesticide labels.

(D) Hygiene

Personal washing facilities are available at the work site and should be used before eating or smoking, or in case of contact with the pesticide, before going home. Employees should be cautioned to not let safety awareness slip as the day progresses.

See Section C2.25: Proper Use and Handling of Pesticides.

(E) Employees who service pesticide equipment (including mechanics) shall be properly informed of the potential pesticide hazards and advised of the proper protective measures to employ while working on that equipment.

See Section C2.25.4: Preparing Spray Equipment for Repair.

(F) The trainer and the employee shall sign the Pesticide Safety Training Record at the completion of the training. One copy is given to the employee, one shall be kept in the employees work location, and one copy shall be sent to the District Landscape Specialist.

C2.25 Proper Use and Handling of Pesticides

Pesticides shall always be used with caution. The following guidelines for the use and handling of pesticides will help minimize the likelihood of injury to people and animals from exposure to such chemicals.

C2.25.1 Labels

Always read labels before using pesticides. Carefully read warnings and cautions before opening the container. Repeat this process every time, no matter how often a pesticide is used, or how familiar the directions are to the user.

C2.25.2 Pesticide Control Recommendation

A licensed Pesticide Control Advisor is required to prepare a pesticide control recommendation for each compound used. Pesticide shall be applied only in the areas and at the amounts and times specified in the recommendation.

See Appendix C2-A: Caltrans Approved List of Herbicides and Appendix C2-B: Caltrans Approved List of Adjuvants.

C2.25.3 Safety Requirements in Loading and Using Pesticides

(A) Personnel involved in spray operations shall be knowledgeable of the material(s), hazards, methods and purpose of the particular operation. The operation must be supervised by someone holding a Qualified Applicator Certificate (QAC).

See Section C2.18: Certification for Applicators of Restricted Materials.

"Supervision" does not mean the civil service rating of the person. but refers to the oversight control by someone who may or may not be present when the work is actually performed. Contact with the crew by the supervisor must be sufficiently frequent to assure adequate control of the work.

(B) Protective clothing and proper eye and respiratory protection shall be worn as required by policy and the label. Pesticides are particularly hazardous when in their concentrated form.

Gloves shall be worn where the label states "avoid contact with skin," or "do not get on skin," or a similar statement. Whenever use of gloves is required, employees shall be provided with clean gloves each work day. Clean gloves shall be either unused gloves or previously used gloves which have been thoroughly washed in soap and water, both inside and outside.

See the Maintenance Manual, Volume 2 for Caltrans guidelines for label interpretation of protective clothing requirements.

(C) Workers shall wear respiratory protection when required by the pesticide label. Employees must be certified to use respirators.

See the Caltrans Safety Manual, Chapter 14: Respiratory Protection.

(D) Workers shall attend training prior to handling pesticides.

See Section C2.24: Annual Pesticide Workers Safety Training.

Training must be completed before the employee is allowed to handle pesticides and at least annually thereafter.

(E) Employees shall not smoke, eat, chew gum, use chewing tobacco or snuff when mixing or applying pesticides.

(F) Employees shall never use their mouths to siphon liquids from containers or to blow out clogged lines.

(G) Avoid drift of sprayed pesticides. Chemicals must be confined to the property being treated and drift avoided by stopping treatment if the weather conditions are not favorable.

(H) Do not spray pesticides with leaking hoses or connections.

(I) Remove clothing immediately if it is contaminated with spilled pesticides.

(J) If pesticide contaminates skin, wash the area thoroughly with cool water and soap. Follow the pesticide label directions for additional instructions.

C2.25.4 Preparing Pesticide Application Equipment for Repair

Prior to delivering pesticide equipment for repair to an equipment shop, vendor, or field mechanic, workers shall conduct the following decontamination and notification procedures:

(A) Spray tanks shall be flushed with clear water and an appropriate cleaner to remove pesticide residue before servicing or repairing

(B) All pipes, hoses, and other locations that may contain pesticides shall be flushed to prevent any pesticides from draining back into the tanks.

(C) The supervisor responsible for delivering the equipment to the shop or field mechanic shall ensure attachment of written information, for the last pesticide used in the tank, to the equipment:

(1) Name of last material used in tank;

(2) Recommended protective devices or equipment necessary; and

(3) Poisoning symptoms.

Equipment Service Center employees who may come into contact with pesticide residues should attend Pesticide Worker Training. If necessary, they should also attend respiratory training and be certified for use of respirators.

C2.26 Considerations in Planning a Chemical Vegetation Control Program

Prior to selecting a herbicide for vegetation control, alternative control methods should be considered and adopted if feasible, practical, and economically sound.

See Section C2.08.1: Natural and Biological Controls.

If it is determined that chemical means of control are best, districts must carefully plan their programs. This section provides a list of considerations in planning chemical vegetation control.

(A) Considerations in the Planning Stage

The success of a chemical vegetation control alternative is dependent upon a number of factors. The omission of any one factor can seriously affect the program. Districts should consider the following when planning their chemical vegetation control programs:

(1) Determination of the problem and the final desired result.

(2) What types of vegetation need to be controlled.

(3) The soil types and slope in the target area.

(4) The area's rainfall and climate.

(5) Whether vegetation removal will be selective or non-selective.

(6) Whether a goal is growth regulation rather than elimination of vegetation.

(7) Need for fuel load reduction for fire prevention.

(8) Characteristics of the target plants.

(9) Adjacent land use.

(10) Environmentally sensitive areas.

(B) Criteria for selection of herbicides used on highway right-of-way are, in order of importance:

(1) Safety

(2) Performance

(3) Economy

(C) Timing of Application

Timing of application is a determining factor of final results. The timing depends on the type of herbicide used. The following lists basic considerations:

(1) Application of a pre-emergent herbicide prior to germination of seed will prevent a vegetative cover.

(2) If roots are wanted, but not a top growth, spraying is performed after germination when the vegetation is small enough to leave no fire hazard when dry.

(3) Systemic herbicides must be applied when vegetation is actively growing and when foods are moving downward to the roots. This usually coincides with optimum soil moisture conditions.

(4) Temperature and moisture dictate timing of application. Some herbicides require warm temperatures, others humidity and some act only when the temperature is cool. Rain after application is required with some and defeats the purpose with others.

Carefully follow label instructions and the instruction provided with the Pesticide Recommendation. See the following Section C2.27: Selection of Herbicides.

C2.27 Selection of Herbicides

C2.27.1 Contact Herbicides

Contact herbicides may be used to control existing weeds within landscaped areas where a chemical soil treatment might not be desirable.

Contact herbicides destroy the portions of plants on which they are sprayed. Their prime use is to destroy annual plants which will not grow from the roots when the top is dead.

They may be used to "knock down" or kill top growth on perennial plants, but the root system of perennials is not destroyed by single applications of contact sprays.

Contact herbicides may be used to control vegetation where a future roadside planting is anticipated since they leave no serious toxic residue. They may also be used for edging ground covers.

C2.27.2 Pre-emergent Herbicides

Pre-emergent herbicide materials are applied to the soil before the unwanted weed seeds germinate. They may be selective or nonselective in the plants they control. Selective preemergent herbicides are useful in landscape maintenance. Some pre-emergent materials may be used in varying quantities to produce either a selective or a nonselective result when applied.

Higher rates of these soil acting (pre-emergent) herbicides are used chiefly in fire prevention strips, under guardrails, sign and sight posts, at bridge and culvert heads and along fence lines.

Pre-emergent soil acting herbicides are applied in spray or pellet form to the soil before the end of winter rains and before new vegetation has emerged. A suitable translocating herbicide may be added to the spray mix to remove existing vegetation, or to kill deep rooted perennial plants that are tolerant of the basic herbicide.

A good VCP will provide for alternating between different pre-emergent products every few years to reduce the tendency of weeds to develop tolerance to specific products.

C2.27.3 Translocating Herbicides

Translocating, or systemic herbicides, function by absorption through the foliage or root system of plants. The herbicide circulates to all plant parts, thereby damaging plant cells or upsetting vital physiological patterns. The entire plant is destroyed.

Translocating sprays are generally used to control perennial weeds, shrubs and trees that may not be adequately controlled with other types of herbicides due to their extensive root systems.

Application rates are critical in using translocating sprays. An overdose of the concentrate will often damage the plant only near the point of contact shutting off further opportunity for more product to be absorbed by the circulatory system.

C2.27.4 Herbicide Combinations

Herbicide combinations approved by label and the EIR can be used to remove multiple plant species in one spray operation. For example, it may be possible to eliminate resistant perennials by combining low rate pre-emergent sprays with nonselective or selective translocating material.

C2.27.5 Growth Regulators

Growth regulators are chemical formulations intended to physically alter the growth of plants.

Growth of shrubs, trees, ground covers and other plants can be effectively controlled by use of these chemicals. This extends the periods between pruning, edging or mowing.

Results are dependent on many factors such as plant material, location, weather conditions, time of year and desired result. Consult label information of various products prior to use. Experiment with materials to determine their effects before general use.

C2.27.6 Brush Spraying

Growth regulators may be used to maintain vegetation at a desired size. Use selective translocating herbicide spray to control new growth annually, or when needed. Do not spray large vegetative woody material before mowing, then leave the material to become an unsightly fire hazard. Small regrowth under 12 inches (0.3 meters) in height may be sprayed without further removal.

Roadside brush may be effectively removed and controlled with chemical sprays. Brush which is more than 1 foot (0.3 meters) in height should be cut and removed before spraying. The stumps may then be painted or sprayed with a "basal" treatment of Glyphosate (Roundup), or an alternate material registered for basal treatments. Any new shoots may be sprayed the following summer with a foliar translocating spray.

Brush which is less than 1 foot (0.3 meters) in height may be killed with foliar translocating spray. Roadside brush and small trees which are sprayed with a translocating herbicide should be sprayed over their entire surface areas. Spraying a portion of such plants leaves an unsightly plant that is partly dead and partly alive.

See Section C2.28: Pesticide Spraying Operations

C2.27.7 Adjuvants

Adjuvants are designed to alter the spray mixture to enhance the effectiveness of herbicides. An example is one which increases herbicide effectiveness by reducing surface tension of the carrier and thereby providing greater contact of the chemical with the plant.

Some adjuvants buffer pH, provide penetration of waxy plant coatings, aid translocation or alter the sticking ability of the solution. Others control evaporation, drift, or the release of the chemical in the solution.

Adjuvants are not added to some products by the manufacturer because they are not compatible with the herbicide in the container. In this case they must be combined just prior to use.

The amount of adjuvant to use is determined by the spray rate. Carefully follow the PCA recommendation. Not all of these materials act the same, so the proper one must be chosen for the specific job. There are many different adjuvants. Herbicide manufacturers do not list the products which effectively enhance their products, so applicators will need to rely on their experience to determine the correct adjuvant for particular applications.

C2.27.8 Chemical Injection Systems

The 1000 gallon (3785 liters) spray truck with chemical injection system is considered standard equipment for roadside spray operations. Larger or smaller spray units with injection equipment will require special justification before being purchased. All Equipment Budget Request (EBR's) for spray equipment will be approved by the Office of Roadside Maintenance before being purchased.

Chemical injection units should be used by crews that have large areas to be sprayed and large volumes of chemicals to use. This equipment provides the best control of spray rates and provides maximum flexibility for adjusting spray combinations.

Chemical injection units are very expensive to purchase and only perform as designed when kept clean and well maintained and are operated by trained personnel.

C2.28 Pesticide Spraying Operations

Successful spray application depends on a number of factors including using the correct product, economy, timing, and soil conditions. Planning is required to ensure that spray operations are safe for the operator and the traveling public, that they will not adversely impact adjacent land use, or injure crops and animals. Planning must consider the residual qualities of particular herbicides. Finally, planning must include the proper rate and method of application must to assure good results. Care must be exercised in filling tanks and washing equipment to be sure harmful chemical are not transported to desirable plant or animal life.

(A) Pressure

Common pressure for spraying of herbicides is 40 psi (276 MPa) at the nozzle to avoid drift and turbulence. In some instances pressures up to 200 psi (1379 MPa) may be used to obtain better coverage when spraying brush, cattails, Johnson grass and other large or dense growths.

(B) Rate of Spray

The rates of systemic or contact herbicides must be adjusted to compensate for the total leaf area when applied to thick stands of tall vegetation or brush. The quantity of carrier must be sufficient for thorough wetting of the plants.

It is common practice to use varying rates of the active ingredient per acre, reflecting the density of foliage.

For example, 100 gallons (379 liters) of spray may be required to thoroughly wet an acre of low grasses on which four pounds (1.8144 kilograms) of the active ingredient of an herbicide is required. An acre of taller grass, however, might require 300 gallons (1135 liters) of mix containing 12 pounds (5.4432 kilograms) of the active ingredient to cover the additional leaf area.

(C) Adjuvants

Adjuvants can increase herbicide effectiveness. They can decrease surface tension of the carrier allowing faster absorption of the chemical by the plant or they may increase the ability of the spray to adhere to the plant.

See Section C2.27.7: Adjuvants.

(D) Travel Speed

Herbicide effectiveness may be reduced if spray vehicle travel speed is not coordinated with the planned treatment rate and if the pressure and nozzle size are not correct. Too much speed for the calculated rate and pressure could result in an ineffective application, while slower than calculated speed could result in over application.

Speed of travel together with nozzle output shall be calibrated to attain desired rate of application.

(E) Nozzle output should be calibrated at least twice each working day. Operators shall exercise extreme caution with the higher pressures because of the potential for wind drift caused by reduced droplet size.

(F) Agitation

Equipment shall be adjusted to ensure proper agitation. Proper agitation within the spray tank prevents settling of suspended herbicidal materials and an ineffective spray operation.

(G) Equipment, including hoses and spray wands or guns, shall be clean and checked for safe and proper operation prior to beginning of operation.

(H) Pesticides shall be accurately measured to assure correct rate of use.

(I) Wettable powders shall be premixed into a slurry form before adding to the spray tank.

C2.29 Guidelines for Ordering Pesticides

Each district should keep an adequate supply of frequently used chemicals and allow for the time required to purchase additional material. This is not a blanket approval to warehouse excess quantities of chemicals. Order only what is needed and specify delivery dates before the season of planned use. This will guarantee timely delivery and eliminate warehousing large quantities for long periods of time.

Chemicals should be ordered in the largest containers practical to the operation. Materials purchased in drums are usually less costly per gallon than materials packaged in 1 gallon (3.785 liter) containers. The problem of disposal of empty containers is reduced by the recyclable larger containers.

Smaller containers may be justified if there will be economy of operation. Truck or carload lots of fertilizers are less expensive per ton when purchased in this quantity.

If no other product will do the job or if there are compatibility problems with other chemicals, this information shall be included with orders for chemicals to justify purchasing a specific material.

All pesticide purchases must be approved by the Landscape Specialist in the district or by the Maintenance Program, Office of Roadside Maintenance. There are a variety of purchasing methods to provide for quick receipt of material with a minimum of warehousing.

The following purchasing methods may be used:

(A) Incidental Purchases

Contract Delegation Purchase Orders g can be used for non-contract purchases up to $14,999.99 (before tax and freight). Two quotations are required. Purchase requests that limit the bidding to one brand or product must have a Sole Source/Limit To Brand Justification Form completed and attached to the file for documentation purposes.

(B) Contracts

Chemicals on State Contract may be ordered on a Contract Delegation Purchase Order without regard to monetary limitation.

(C) Emergency Purchases

If emergencies arise, chemicals exceeding $14,999.99 may be purchased on a Contract/Delegation Purchase Order Form 42. Standard procedures for using the Form 42 emergency purchase process are to be followed.

Personnel not familiar with the emergency purchase process should contact the Office of Procurement and Contracts prior to calling venders for bids.

As stated above, purchase requests which limit the bidding to one brand or product must have a Sole Source/Limit To Brand Justification Form completed and attached to the file for documentation purposes.

APPENDIX C2-A

Caltrans Approved Herbicide List
July 1, 1997

HERBICIDES	BRAND NAMES
Ammonium sulfate (dessicant)	Fertilizer
Bromacil	Hyvar, Krovar 40%
Cacodylic acid	Phytar-560, Montar
Chlorsulfuron	Glean, Telar
Dicamba	Banvel
Dichlobenil	Casoron
Diquat	Reward
Diuron	Karmex, Direx
Fluazifop-p-butyl	Flusilade,
Glyphosate	Roundup, Rodeo, Expedite
Halosulfuron-methyl	Manage
lsoxaben	Gallery
Magnesium chloride	Killer
Mefluidide	Embark
MSMA	
Napropamide	Devrinol
Norflurazon	Predict
Oryzalin	Surflan
Oxadiazon	Ronstar
Oxyfluorfen	Goal
Pelargonic acid	Scythe
Pendimethalin	Stomp, Pendulum
Prodiamine	Endurance
Pronamide	Kerb
Sethoxydim	Poast
Simazine	Princep, Sim-Trol
Sulf6meturon methyl	Oust
Tebuthiuron	Spike
Triclopyr	Garlon
Trifluralin	Treflan

APPENDIX C2-B

Caltrans Approved Adjuvants List
July 1, 1997

Acidiphacant
Activator 90
41 -A Drift Retardant
Activator N.F.
Agicide Activator
Agridex
Bivert
Blazon Blue
Blazon E-Z
Buffer-X
Bullseye
Chem-Trol
CMR Herbicide Activator
CMR Pesticide Equipment Cleaner
CMR Spreader Sticker
Exact-Trol
38-F Drift Retardant
Foam Fighter
Hasten Spray Adjuvant
Hi-Light Green
Magnify
Mark It Dyes (Green and Blue)
Mor-Act Adjuvant
No Foam
No Foam A
No Foam B
Para-Spread
Penox
Pro Herbicide Enhancer
Odor Mask
R-11 Spreader Activator
R-56 Spreader Sticker
Spray Tech Oil
Sta-Put
Suspen-Der
Sylgard 309
Target Pro-Spreader Activator

APPENDIX C2-C

Vegetation Management Unit Plan

VEGETATION MANAGEMENT UNIT PLAN

District _____ County _____ Route_____ Postmiles _____

This vegetation control decision making outline should be used to determine control methods and widths for this unit. A unit consists of a road segment with approximately uniform characteristics. This outline should be reviewed annually and kept on file.

Completed by: _____ Date: _____

UNIT CHARACTERISTICS

A. Natural Landsegpe Region (Ecoprovinces)

O	*Forest Lands*	O	*High Desert*
O	*Valley Grassland*	O	*Low Desert*
O	*Coastal Mountains*	O	*Chaparral*
O	*Oak Woodlands*	O	*Southern Coast*
O	*Delta*		

B. Terrain

O	*Flat*	O	*MountainousISteep*
O	*HillylUndulating*	O	*Water (OceanlLakelWetland)*

C. Prevailing Adjacent Land Use

O	*Natural*	O	*Light Development*
O	*TimberlForest*	O	*Medium Development*
O	*Agriculture- Row Crops, Orchard, Pasture*	O	*High Density Development*

Secondary Land Use (if applicable) type _____ _____%

D. Prevailing _Vegetation Type

Inside R/W	*Outside R/W*	
O	O	*Annual Grass*
O	O	*Perennial Grass*
O	O	*Brush*
O	O	*Dense Trees*
O	O	*Chaparral Brush*
O	O	*Desert Shrubs (Creosote, Sage, etc.)*
O	O	*Landscape Ground Cover*
O	O	*Wetlands (Tules, etc.)*

E. Fire Start Risk		***F. Fire Consequene***	
(Consider chance of fire starting in R/W and consequence to adjacent properties)			
LOW	O	*LOW*	O
MODERATE	O	*MODERATE*	O
HIGH	O	*HIGH*	O

G. Other Considerations

O	*Visibility*	O	*Drainage*
O	*Safety Devices*	O	*Appearance*
O	*Clearance For Disabled Vehicles*	O	*Other*
O	*Protection Qf Paved Surfaces*		

INTERIM VEGETATION CONTROL STRATEGIES
(what will be done now reflecting factors identified above)

STRATEGY (clear strip width or other treatment)
(Enter in vegetation control program)

	FIRE CONTROL (width)	OTHER CONSIDERATIONS (width)
Cut	_____	_____
Fill	_____	_____
Flat (traversable)	_____	_____

(attach detail table for variations from general strategies identified above)

Interim Vemetation Control Strategies (also consider factors in G above)

1. Low Fire Start Risk - Low Fire Consequence:	No Control or 1' to, 2' (.304 m-.698 m) Fire Strip
2. Low Fire Start Risk - Moderate Fire Consequence:	4' (1.219 m) Strip
3. Low Fire Start Risk - High Fire Consequence:	4' to 8' (1.219 m - 2.438 m) Strip
4. Moderate Fire Start Risk - Low Fire Consequence:	Minor Control
5. Moderate Fire Start Risk - Moderate Fire Consequence:	4' (1.219 m) Strip
6. Moderate Fire Start Risk - High Fire Consequence:	8' (2.438 m) Strip
7. High Fire Start Risk - Low Fire Consequence:	Minor Control
8. High Fire Start Risk - Moderate Fire Consequence:	4' to 8' (1.219 m - 2.438 m) Strip
9. High Fire Start Risk - High Fire Consequence:	8' (2.438 m) Strip

FUTURE EDGE DESIGN TREATMENTS
(How future projects should be designed to reduce vegetation control needs)

Construction Or Rehabilitation Projects Programmed In:

STIP (YR.) _____SHOPP(YR.)_____
(check district status of projects)

Date sent to Project Development_____

Left Edge/Right Edge Design Treatments (Choose 1 Or More)

- O None/At Ultimate Condition Now
- O Extra Paving (Specify Width)
- O Extra Paving With a Nonmountable Dike
- O Structure at Base of Cut Slopes (Specify)
- O Cigarette Trap at Pavement Edge
- O Alternative Vegetation Species (Identify)
- O Undetermined

Median Shoulder Edge Treatments (Choose 1 Or More)

- O None/At Ultimate Condition Now
- O 10 Foot (3.05 m) Shoulder
- O Extra Paving --Specify Width
- O Extra Paving And Nonmountable Dike
- O Cigarette Trap At Pavement Edge
- O Alternative Vegetation Species (Identify)
- O Control Full Median
- O Pave Full Median
- O Undetermined

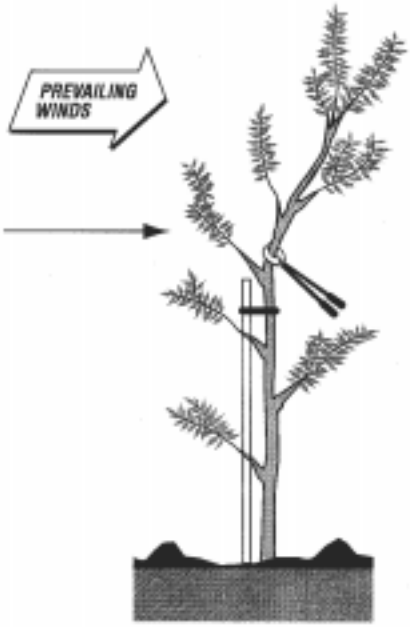
VEGETATION CONTROL METHODS

1. *No Control*
2. *Chemical Spray Strip (Specify Width)*
3. *Mow (Specify Width)*
4. *Hand Pruning*
5. *Mechanical Pruning*
6 *Spot Spray With Chemicals*
7. *Organic Mulch*
8. *Inorganic Mulch*

APPENDIX C2-D

Illustrations of Pruning Methods

TRIMMING YOUNG EUCALYPTUS TREES IN AREAS OF PREVAILING WINDS

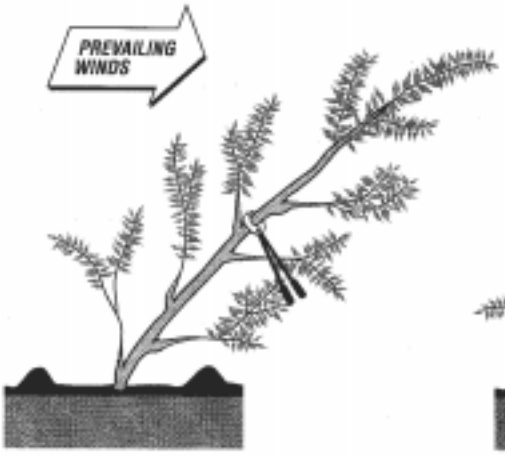


TRUNK NOT AFFECTED

If tree trunk is not affected, cut to an upright lateral.

TRUNK IS AFFECTED

If the tree trunk is affected, the tree can be brought to an upright position using the following steps:



Remove excess weight by cutting the tree to an upright lateral.

Straighten tree trunk when ***soil is wet*** and tamp well.

If the soil is unstable, sand or crushed rock may be added on the side toward which tree was leaning.

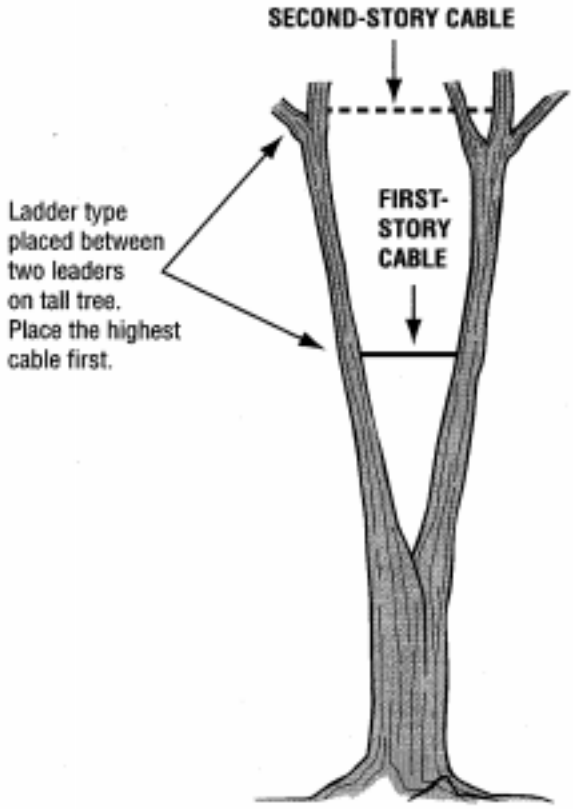
SUPPORT BY CABLES

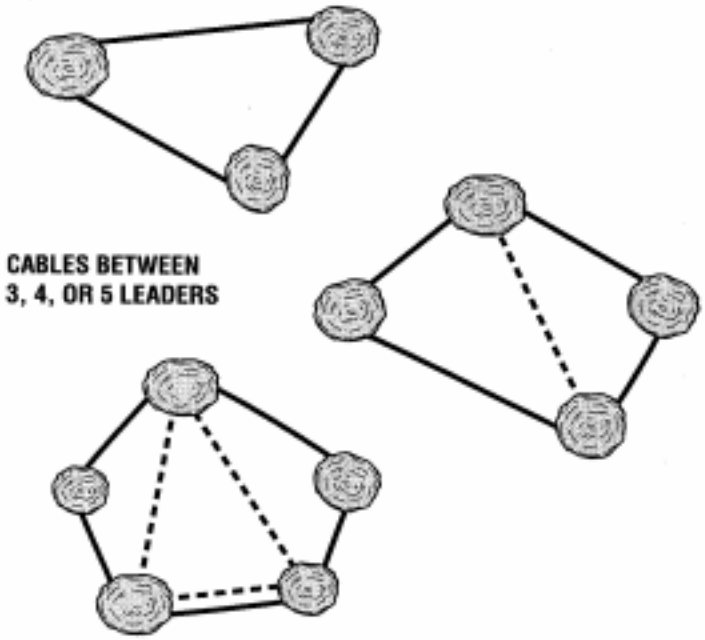
CABLING:

Cable is used to distribute stress — not to suspend weight. Cabling will prevent damage to weak crotches when wind forces cause the tree to whip, side sway, and twist.

Weight can be reduced by proper thinning of limbs and branches or by the reduction of leader height.

Do not use a center suspension system in cabling roadside trees. This method does not afford control of side sway or twisting action on the crotch.



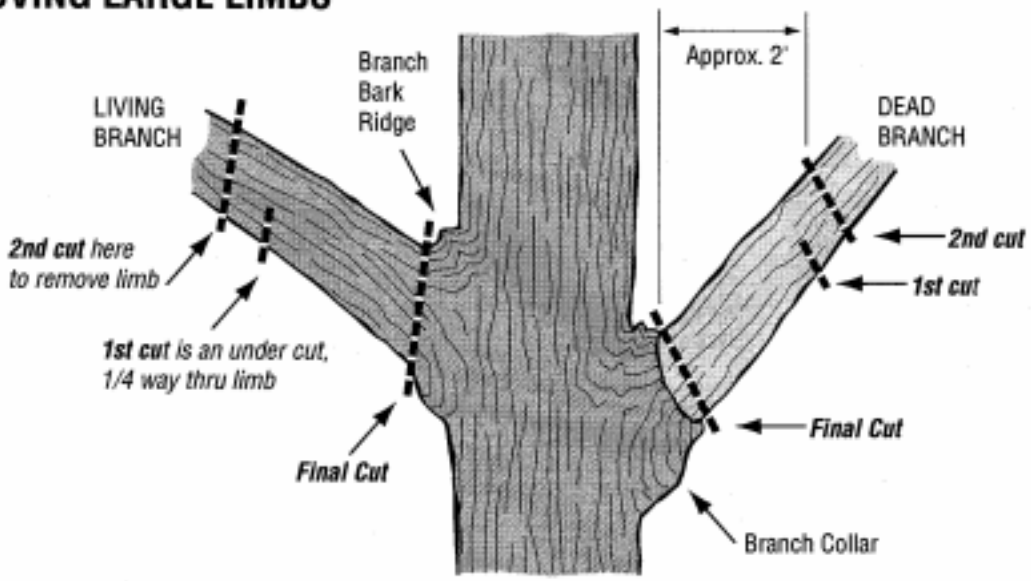


Solid lines indicate the placement of first-story cables. Dashed lines indicate location of any second-story cables.

If second-story cables are needed, install them first.

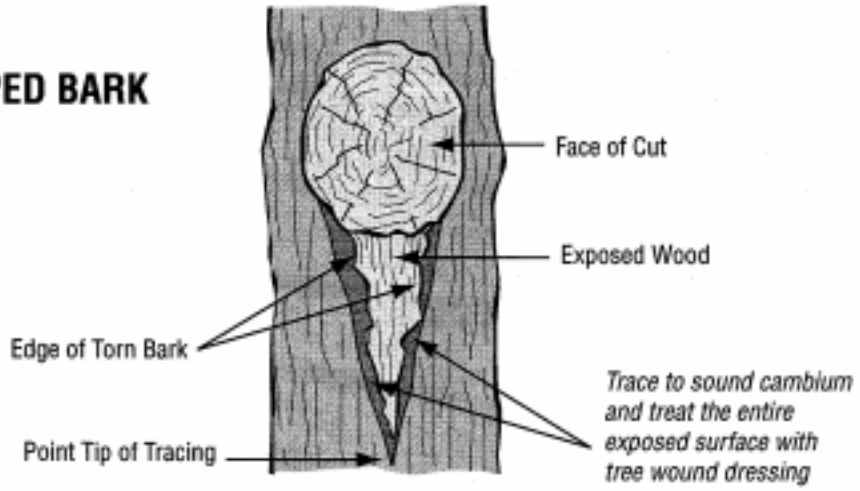
Cables should be tight but not taut. Use no turnbuckles or other tightening devices in the cable. Do not use cable clamps.

REMOVING LARGE LIMBS



When removing a large tree limb, use the three-step process illustrated above in order to avoid bark injury.The same process is used on both dead and live limbs. A proper ***final*** cut begins just outside the branch bark ridge and angles down away from the trunk of the tree. Make the cut as close as possible to the trunk, but outside of the branch bark ridge and the branch collar, so that trunk tissue is not injured and the wound can seal in the shortest time possible. If the cut is too far from the trunk, leaving a branch stub, the branch tissue usually dies and woundwood forms from the trunk tissue. Wound closure is delayed because the woundwood must seal over the stub that was left.

TREATING STRIPPED BARK



PROTECTING SPLIT CROTCH WITH TREE RODS

PROCEDURE:

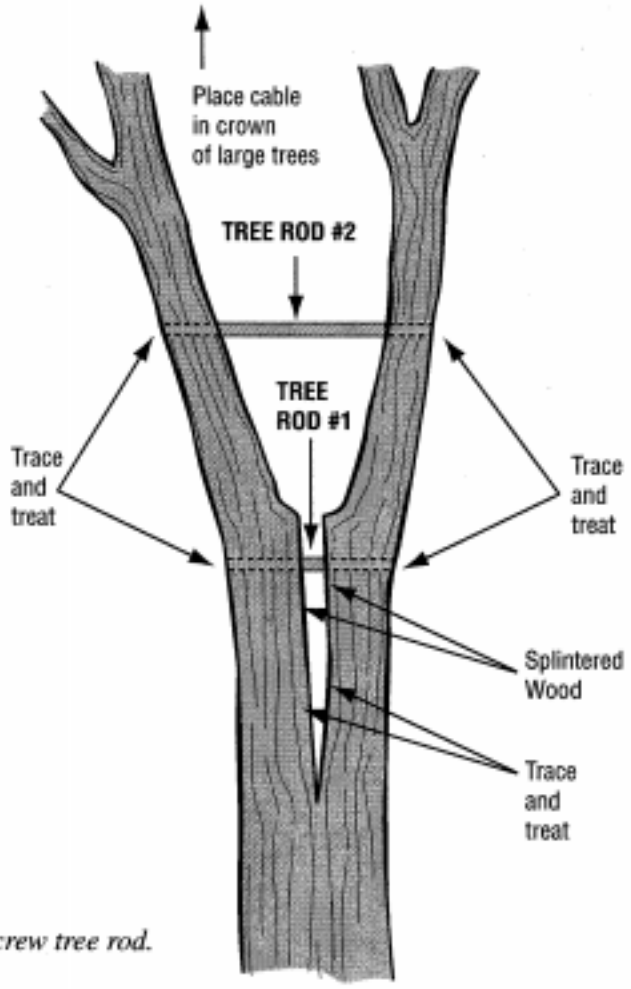
1. Remove splintered wood and clean out split. Run saw to bottom of crack if straight.
2. Pour tree paint into crack.

   Heat or thin paint if necessary to reach bottom of crack.
3. Pull split together with block and tackle. Place tree rod #1. Then place tree rod #2.

   If cables are used in crown, place cables after rods are in place.

   On small trees or branches only tree rod #1 is necessary.
4. Trace and treat all injuries to bark.

DETAIL OF ROD
Use only lag screw tree rod.

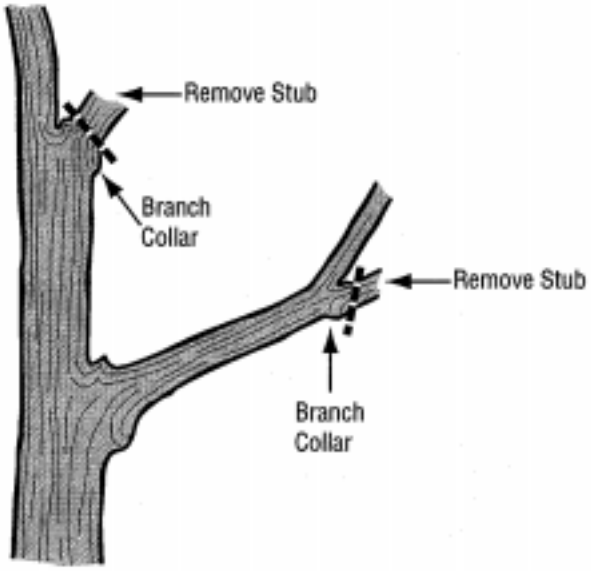


METHODS USED IN TREE TRIMMING

STUBS:

When removing to a leader or lateral, make the cut follow the direction of growth of the remaining portion of the tree.

Avoid injury to the branch collar.



HEAVY BRANCHES:

Remove growth from under limbs to lighten heavy branches.